Phase frequency detector and charge pump

SPECIFICATION

1 FEATURES

- iHP SiGe BiCMOS 0.25 um
- CMOS input signals
- Low disbalance of output current
- Minimum disbalance of the charging/discharge current in loop filter capacitors
- Supported foundries: TSMC, UMC, Global Foundries, SMIC, iHP, AMS, Vanguard, SilTerra

2 APPLICATION

- Phase-locked loop synthesizer

3 OVERVIEW

Phase-frequency detector (PFD) forms control signal for VCO tuning. PFD compares phases of divided VCO signal and divided reference oscillator signal and detects phase difference. Charge pump generates pulses to change VCO control voltage. The CP output stage is an amplifier equalizing a buffer reference voltage of CP output current: adjustment with a loop filter voltage; and an amplifier minimizing the disbalance of the charging/discharge current in loop filter capacitors.
The block is fabricated on iHP SiGe BiCMOS 0.25 um technology.

4 STRUCTURE

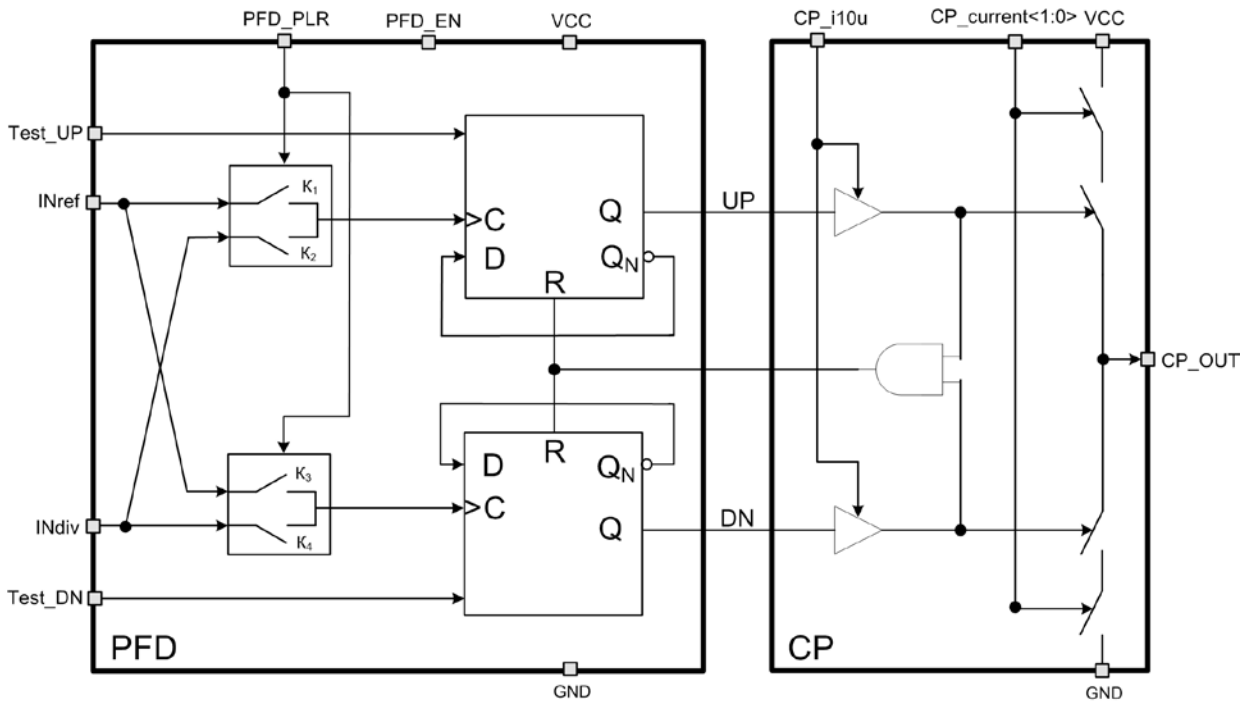

Figure 1: Phase frequency detector and charge pump structure.

5 PIN DESCRIPTION

Name	Direction	Description
CP_i10u	IO	CP reference current 10 uA
IN_{div}	I	PLL VCO divided signal input
IN_{ref}	I	PLL reference oscillator divided signal input
PFD_PLR	I	PFD polarity
PFD_RD	I	PFD reset time control
PFD_EN	I	PFD and CP enable/disable
CP_MD<3:0>	I	The control of offset and accuracy modes for output current adjustment of a loop filter
CP_current<1:0>	O	Output current adjustment of loop filter
CP_OUT	IO	CP output
GND	IO	Ground
VCC	IO	Supply voltage

6 LAYOUT DESCRIPTION

Frequency-phase detector and charge pump dimensions are given in the table 1.

Table 1: Blocks dimensions.

Dimension	Value	Unit
Height	160	um
Width	220	um

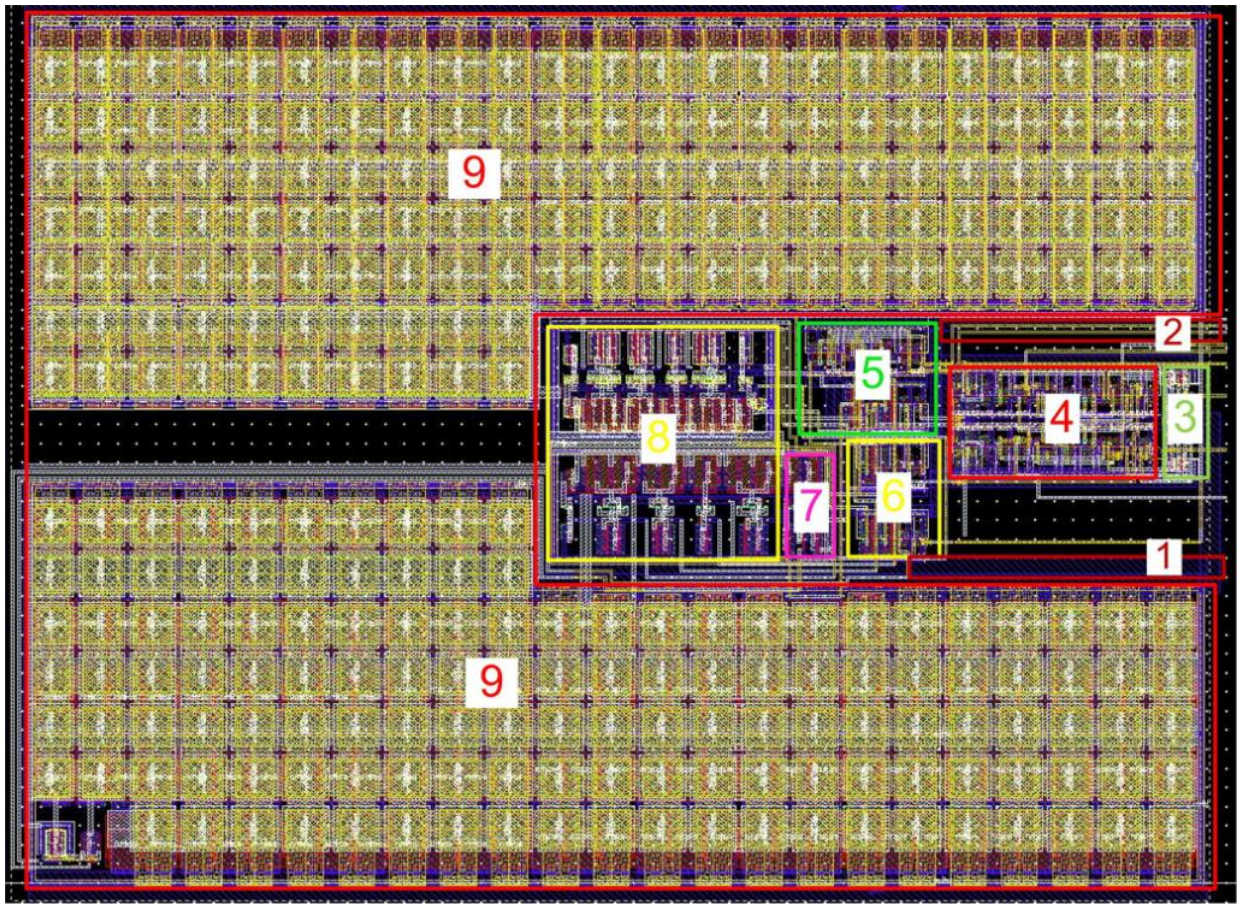

Figure 2: PFD and CP layout view.

1. Ground bus
2. Supply voltage bus
3. PFD polarity switch circuit
4. PFD
5. Charge pump input buffer
6. PFD reset circuit
7. Charge pump reference current source.
8. Charge pump output stage
9. Filter capacitors

7 OPERATING CHARACTERISTICS

7.1 TECHNICAL CHARACTERISTICS

Technology _____ iHP SiGe BiCMOS 0.25 um
Status _____ silicon proven
Area _____ 0.035 mm^2

7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for V_{cc} = 2.65 ÷ 2.75 V and T_a = -60 ÷ +125 °C. Typical values are at V_{cc} = 3.15 V, T_a = 27 °C, unless otherwise specified.

Parameter	Symbol	Condition	Value			Unit
			min	typ	max	
Supply voltage	V_{cc}	-	2.6	2.7	2.75	V
Operating temperature range	T_a	-	-60	27	125	°C
Reference frequency	F_{ref}	-	-	24.84	-	MHz
Peak-to-peak input voltage	$A_{in\ p\text{-}p}$	For inputs IN_{div}, IN_{ref}	V_{cc}–0.3	V_{cc}	V_{cc} +0.05	V
Charge pump output current	I_{out}	Preset 1	41	41.5	42	uA
		Preset 2	61.5	62	63	
		Preset 3	92.5	93.5	94	
		Preset 4	140	141.5	142	
PFD reset time	t_{rst}	-	1.4	2.0	3.1	ns
Supply current	I_{cc}	Preset 4	23.5	23.1	23.2	uA
Stand-by current	I_{stb}	Preset 4	2.5	3.0	5.0	nA
Input logic-level high	V_{IH}	For digital inputs	0.7V_{cc}	-	V_{cc}+0.25	V
Input logic-level low	V_{IL}		-0.25	-	0.3	V

8 DELIVERABLES

IP contents:

- Schematic or NetList
- Layout or blackbox
- Extracted view (optional)
- GDSII
- DRC, LVS, antenna report
- Test bench with saved configurations (optional)
- Documentation